OPTICAL SCANNER

FIELD OF THE INVENTION

The present invention relates to an optical scanner and particularly to an optical scanner for rapid preview and scanning.

BACKGROUND OF THE INVENTION

A scanner is an image-capturing device. Take a conventional platform scanner for example; its basic elements include a glass window for holding a scan object (maybe a document or picture) and an optical module for transforming images to electric signals. The core element of the optical module is an image sensor and a lens for focusing and forming an image on the image sensor. The image sensor (such as charge couple devices; CCD) has many image-sensing pixels, which accumulate electric charges when receiving different light intensities to form voltage differences. Those light intensities are different from those transformed to digital electric signals through an A/D converter. The original digital electric signals can be converted to electronic files. Then users can process image processing, editing, storing, and outputting through computer software.

Refer to FIG. 1 shows the scanning process for a picture from start to finish on a conventional scanner. The description of the process is as follows:

First, confirm that warm up of the lamp is finished (step 11). This step requires some time to enable the brightness of the entire lamp to rise to a stable condition.

Next, AFE (analog front end) data captured by an image capturing front controller are compensated and corrected (step 12). This step is to calculate the CCD output-value according to the following equation (1):

$$\text{gain}\times(\text{CCD output-value} + \text{offset}) \qquad (1)$$

Then, perform pixel-shading pixel to pixel (step 13). This step is to compensate the brightness of every pixel to a desired value so that a uniform brightness is reached before scanning. This serves as the standard for compensating the later scanning object.

Start scanning for the targeted object (step 14) after all prior steps have been completed.

Conventional scanners mostly use a cold cathode fluorescent lamp (CCFL). While CCFL has many advantages such as greater brightness, lower electric power consumption, longer service life, and the like, it also has a big drawback. Namely: whenever a user restarts scanner operation, the scanner has to go through a warm up period to enable the brightness of the lamp to reach a stable condition in order to start the scanning of the picture. Hence at step 11, warm up time takes considerable time.

At room temperature the warm up time could last about 1 - 3 minutes. In colder areas the warm up time is longer. This is quite inconvenient. Some users even mistakenly deem the long warm up time as a machine failure and send the machine back for repairing.

In the present highly competitive environment, how to shorten the waiting time period when the scanner is cold started is an important issue.

SUMMARY OF THE INVENTION

In view of the problems set forth above, the object of the present invention is to provide an optical scanner that includes a glass window, an optical module, a first reference white board and a second reference white board.

The first reference white board is located on one side of the glass window and the second reference white board is located on another side of the glass window perpendicular to the first reference white board.

After the optical scanner has been powered on, the optical module first scans the first

reference white board to perform an image quality test. Meanwhile, the warm up of the lamp of the optical module is still not finished; hence, the optical module scans in the Y direction along the second reference white board, to obtain brightness variation of every spot in the Y direction.

Thus by means of the result of the image quality test and the brightness variation of every spot in the Y direction, the stable brightness of the lamp may be simulated. Through software compensation and correction, more normal digital image data may be obtained. Thus scanning may be started without waiting for the brightness of the entire lamp to reach a stable condition, and an instant preview or scan can be achieved.

The foregoing, as well as additional objects, features and advantages of the invention will be more readily apparent from the following detailed description, which proceeds with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a process flow chart of a conventional scanner from start, complete warm up and start scanning a picture.

FIG. 2 is a schematic view of a first embodiment of the optical scanner of the invention.

FIG. 3 is a schematic view of a second embodiment of the optical scanner of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Refer to FIG. 2 for a first embodiment of the optical scanner of the invention. It mainly includes a glass window 10, an optical module 20, a first reference white board

30 and a second reference white board 40.

The glass window 10 is for holding an object to be scanned. The optical module 20 is movable relative to the glass window 10. Its main elements include a lamp (such as CCFL), lens, an image sensor, A/D converter, etc.

The lamp emits light projecting to the object to be scanned on the glass window 10. Take a black and white picture as an example, the light emitted from the lamp hits the black or white spots, and the reflecting light is different. The reflected light passes through the lens and focuses. The image sensor transforms the optical signals to analog signals. The analog signals are converted by the A/D converter to become digital image data. The digital image data are sent to a computer host. Coupled with software such as a TWAIN driving program, image processing, word recognition, etc., the image may be edited.

The first reference white board 30 is located on one side of the glass window 10. When the optical scanner is powered on, the optical module 20 first scans the first reference white board 30 to perform an image quality test.

The first reference white board 30 is a totally white board. Assume the corresponding value of the white color is 240 (may be set with other value). The image sensor of the optical module 20 detects the value of the first reference white board 30 (at this time the lamp is still at the warm up stage. Hence output value of the image sensor is not necessary 240) which is compared with the corresponding value 240 of the white color, and an AFE data is obtained. Then the AFE data may be used to correct output image.

The second reference white board 40 is perpendicular to the first reference white board 30 and is located on another side of the glass window 10. After the optical scanner has been powered on and the image quality test is completed, the optical module 20 is moved in the Y direction (the second reference white board 40) to perform

selected positioning operations for a scanning process and to enable the brightness of the lamp to reach a stable condition.

By means of the invention, the optical module 20 can move in the Y direction, and use the dummy pixels on two sides of the image sensor to scan the second reference white board 40 and measure the brightness of every spot in the Y direction, to obtain brightness variations in the entire Y direction.

Therefore the image sensor can scan respectively the first reference white board 30 and the second reference white board 40 to obtain AFE data and brightness variations in the Y direction and through software compensation and correction, normal digital image data may be obtained.

When the optical module 20 processes scans in the Y direction the first time, the AFE data and brightness variations in the Y direction are used to simulate the warm up finished condition of the lamp (i.e. the lamp with a stable brightness), so that instant preview or scanning starts without waiting the lamp to reach a stable brightness. Thus waiting time of cold start prior to scanning may be shortened.

Aside from using the dummy pixels on two sides of the image sensor to scan the second reference white board 40 to obtain brightness variations in the Y direction, an additional photosensitive diode may be mounted on one side of the image sensor 20 to scan and measure the brightness of every spot of the second reference white board 40 in Y direction. The brightness variations in the entire Y direction are also obtained. Then use the obtained AFE data and brightness variations in the Y direction, and through software compensation and correction, to obtain the normal digital image data.

Refer to FIG. 3 for a second embodiment of the invention. It is substantially constructed like the first embodiment. However, a third reference white board 50 is provided and located on another side of the glass window 10 perpendicular to the

second reference white board 40.

After the optical scanner has been powered on and has finished an image quality test, the optical module 20 scans the second reference white board 40 to obtain brightness variations in the Y direction, and scans the third reference white board 50 to obtain required data. Through software compensation and correction, more accurate digital image data than the first embodiment may be obtained. It also can achieve rapid preview or scanning.

While the preferred embodiments of the invention have been set forth for the purpose of disclosure, modifications of the disclosed embodiments of the invention as well as other embodiments thereof may occur to those skilled in the art. Accordingly, the appended claims are intended to cover all embodiments, which do not depart from the spirit and scope of the invention.